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THE RUBBER PLANTS OF MEXICO*

By H. H. Rusby

Until within a few years, there was but a single known source of commercial rubber in the entire republic of Mexico. Now two species are contributing regular supplies, and a third, to be specially considered here, is likely soon to become a very important factor in this industry. Mexico thus becomes one of the most important of the world's rubber-producing countries.

That other sources remain to be developed is very certain, since the families Euphorbiaceae, Moraceae, and Apocynaceae, which comprise most of the rubber-yielding plants, are abundantly represented in the Mexican flora. The same may be said of the Sapotaceae, the family that yields gutta percha, chicle, and balata.

The first of the rubber-producing plants mentioned above is *Castilla elastica*, the Central American rubber tree known also as the Mexican rubber tree or "hule," in all but recent literature. So abundant is this tree in one locality, that it and its railroad station are known as El Hule. This tree also yields rubber in the West Indian Islands. It is a near relative of the *Ficus*, yielding the East Indian rubber, to which its product bears considerable resemblance. On the other hand, it is not related to the *Hevea*, which yields the superior Para or Amazon rubber. The *Castilla* becomes a large tree, some authors state up to six feet in diameter, and lives to a great age. Owing to the destructive methods of collecting its latex, the exportation of Mexican rubber declined from $160,000 in 1882–3 to $47,000 ten years later, and the government was faced with what threatened to be

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the practical extermination of the tree. It therefore not only established rules for the method of collection, but offered a handsome subsidy for the planting of the trees. This is one of the most satisfactory of rubber trees for cultivation. It grows well

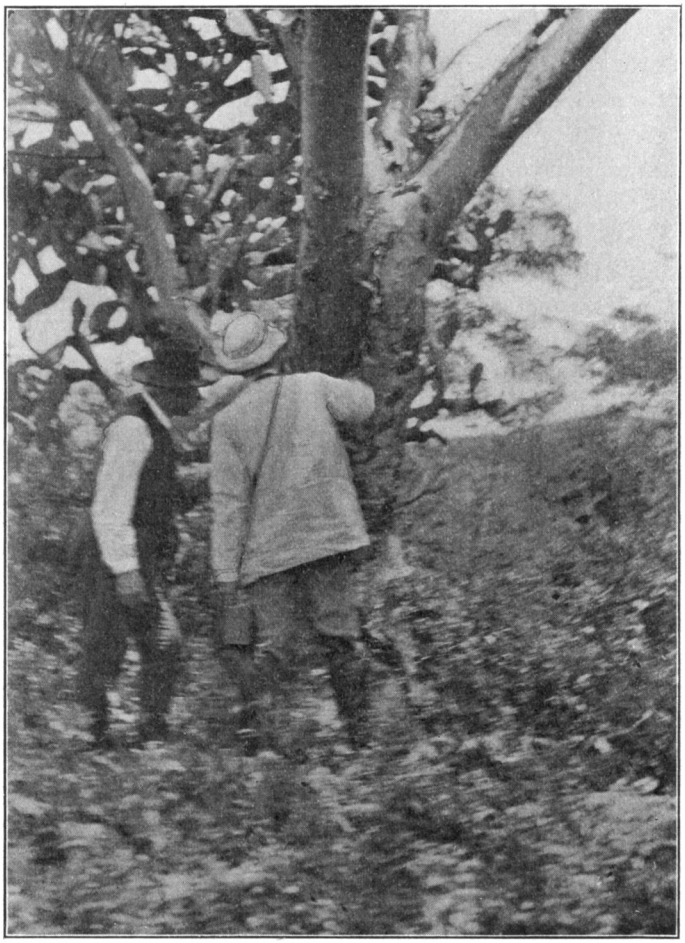
Collecting milk from a tree that bears more than 40 wounds from previous collections.

up to an altitude of 1,500 feet and requires a well-distributed rainfall of at least 100 inches, and good drainage. The seeds must be planted very soon after collection, as they do not long retain their vitality. At one year old the tree is about three feet

high, and collection can commence when it is from five to seven years of age. Although a number of trees can often be found in proximity, the species can by no means be classed as gregarious. The milk, after collection, must be coagulated artificially. This is mostly accomplished by boiling in water, which causes the rubber to separate as a superficial crust; it is then dried and hardened by rolling. The same result is sometimes obtained by merely mixing the milk with water and allowing it to stand. Sea water acts much better than fresh water. Sometimes the coagulation is accomplished by means of adding citric or sulphuric acid. The yield of rubber is nearly one half of the weight of the latex, and the rubber is of only medium quality.

The second variety of rubber to be considered is produced in a region where all the conditions are opposed to those of the well-watered *Castilla* region, namely, the high and dry table-land of the northwestern district. Owing to the high degree of radiation, this region differs also in being subject to a great variation of temperature by day and night, respectively, yet it can be regarded as a hot district. During midday the heat is often extreme. It is excessively dry, the amount of rainfall, even in the short rainy season, being but moderate. Except for some large yuccas, and a few leafless species, trees are almost wanting, and the shrubs are mostly low and stunted. Among these shrubs occurs one which has been described before in TORREYA, namely, *Parthenium argentatum;* it is an important rubber-yielder, and therefore called "guayule," the Indian equivalent for "wild rubber." It is a low shrub of some two or three feet in height, of robust and densely branching habit, and somewhat gregarious. The stem is rarely so thick as the wrist and branches from the base, the branches being rather short and stout. This shrub is of very slow growth, requiring probably forty or fifty years to reach its full size. It is as yet too little known to enable us to say how many years it must grow before it will yield sufficient rubber to be worth harvesting, but this is believed to require fifteen years or more. Little is known about its natural methods of reproduction, but it appears to propagate sparingly, in the desert, from seeds. The prospects for a new crop of rubber within a human

generation, when all the shrubs of a district have been uprooted, are therefore very poor. Advantage has been taken of this peculiarity by those engaged in exploiting it, to bring about a monop-



Examining a tree that has been improperly cut. (Dr. Rusby at the left, Dr. Altamirano, Director Nat. Med. Institute of Mexico, at right.)

oly. Having purchased all the most important guayule lands, they offered to purchase the shrubs collected from the outlying districts. The price, at first $10 per ton, has been advanced to

$130, a price so high as to tempt the collectors to uproot it, a process which is certain to exterminate it except on the company's own lands.

When it was first suggested that rubber could be obtained from this shrub, a member of the daisy family, the greatest incredulity was encountered, and the enlisting of capital in the enterprise was a matter of extreme difficulty. At present, the total capitalization of the interests engaged in this enterprise is said to be about $130,000,000, and there is every prospect that even on this great scale, the business will be very profitable.

The collection of this variety is by a method unknown elsewhere in the rubber industry. By it the entire woody portion of the plant is finely ground, and the rubber extracted by liquids from the dust.

The third, and what we may call the new variety of Mexican rubber, is also unique as to its character, and the methods employed in preparing it. It is produced by the *Euphorbia elastica*, and is therefore a near relative of the Para rubber.

This tree inhabits a region intermediate in location and climatic character between those producing the two previously described varieties, namely, the hilly country where the western edge of the table-land breaks down into the coast slope, at an altitude mostly of from 5,000 to 7,000 feet. The climate of this region might be called subtropical. The banana and orange grow here, but only exceptionally produce fruit. Some poor apples are grown and corn is the staple agricultural product. Although there is a long dry season, the rainy season is long enough, and its rains abundant enough, to produce the crops without irrigation, for the most part.

This *Euphorbia* will not grow on the alluvial plains, but only on the rough rocky hillsides, where the drainage is good. Its arborescent associates are Randias, Acacias, Convolvuli, and a number of Cactaceae. It is a gregarious species, the branches often interarching over considerable areas, although many smaller trees and shrubs are intermingled. It is a rather small tree, the trunks usually less than two feet in diameter, and the height usually under fifty feet. Its branches and branchlets are rather

few and massive, there being a dearth of fine twigs. It is therefore not very leafy and does not afford much shade. The leaves are mostly crowded at the ends of the branchlets, and are oblong, thick and smooth, and about six inches in length by one to one

A thick growth of Palo Amarillo trees, about 40 to the acre.

and a half in breadth. The bark is thick and rather succulent, at first smooth and of a light or yellowish green color. That of the trunk and large branches soon exfoliates in large, very thin, papery, translucent sheets of an orange-yellow or orange-red

color, which impart a shaggy appearance, and a color that has given the tree its vernacular name "palo amarillo," or yellow trunk, which becomes also the commercial name of this variety of rubber. The flowers appear in January, or there-about, before the appearance of the new leaves, and the fruits mature in June and July. The seeds, which are much like those of the castor-oil, contain about 50 per cent. of a fatty oil, which can be pressed out, and is good for soap-making.

As soon as the bark is wounded, a milky juice exudes which is very irritant and capable of producing violent inflammation of the eyes if it enters them, as it is quite liable to do in spattering when the tree is cut. A part of this latex soon coagulates, but the coagulum is soft and curdy, rather than tough and elastic, like that of most rubber milks. Rather more than half of it does not coagulate at all, except as a result of drying out. The coagulated portion contains the rubber, about ten per cent. of the entire weight, but with it there is more than twice as much resin. It is this intimate mixture of resin with the rubber that compels a resort to different processes for the manufacture of this rubber from those which apply elsewhere in the rubber industry. The separation has to be effected by solvents, and by the aid of special machinery. Nevertheless, the cost is inconsiderable, and the business bids fair to be very profitable.

The great value of this tree as a rubber-producer lies in its abundance over large areas, and the proximity of the trees to one another, facilitating collection of the milk, as well as the ease with which it can be propagated, and the rapidity of its growth. All that is necessary for propagation is to thrust the newly cut branches into the soil, where they practicallly all grow. From them the tree reaches its full size in from five to seven years. These considerations appear to justify the opinion that if all other sources of rubber were to fail, this one could probably supply the world's entire requirements.

It may be added that this and several similar species form a peculiar division of the genus which will in all probability be elevated to generic rank. It is said that one known as the "palo colorado," or red trunk, growing in the northern part of

the palo amarillo region, and mingled with the latter species, is probably another member of this group.

The properties of the palo amarillo rubber are peculiar. Taken by itself it is of only medium quality, but mixed in suitable proportion with other varieties, especially with Para rubber, it markedly improves them.

TWO NEW FOSSIL PLANTS FROM FLORISSANT, COLORADO*

By T. D. A. Cockerell

Polypodiaceae

Hypolepis coloradensis n. sp.

Pinnules about 2½ mm. long, oblong or obtusely subtriangular, connected basally, and bearing two to four large round marginal sori, which as preserved are very dark in color. In general structure and appearance, the plant closely resembles *Hypolepis repens* (L.) Presl, as figured by Shimek in Bull. Lab. Nat. Hist. Univ. Iowa, IV (1897), pl. v, f. 4. The more usual forms of *Hypolepis* have only one or two sori to the pinnule, but no doubt the earlier condition is one in which they are numerous, as in *Adiantum*.

Habitat. — Miocene shales of Florissant, Station 14; fragments only. The genus is to-day common in the West Indies and Central America.

Caesalpiniaceae

Bauhinia pseudocotyledon n. sp.

Leaf circular in outline, or nearly so, 16 mm. long and 18 broad, as preserved dark in color, apparently thick; the median sinus about 6 mm. long, its sides, except apically, very close together; venation indistinct, but with a lens it is possible to see clearly a mid-vein running to the sinus, and two strong laterals, as shown in the figure; petiole short, about 2 mm., twisted to one side. From its dark color, apparent thickness, and obscure venation, I thought at first that this was a cotyledon, probably of *Ipomoea*, possibly of some Sterculiaceous plant related to *Pentapetes*. A closer scrutiny shows, however, that the venation will not accord with these. In the seedlings there appears to be

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